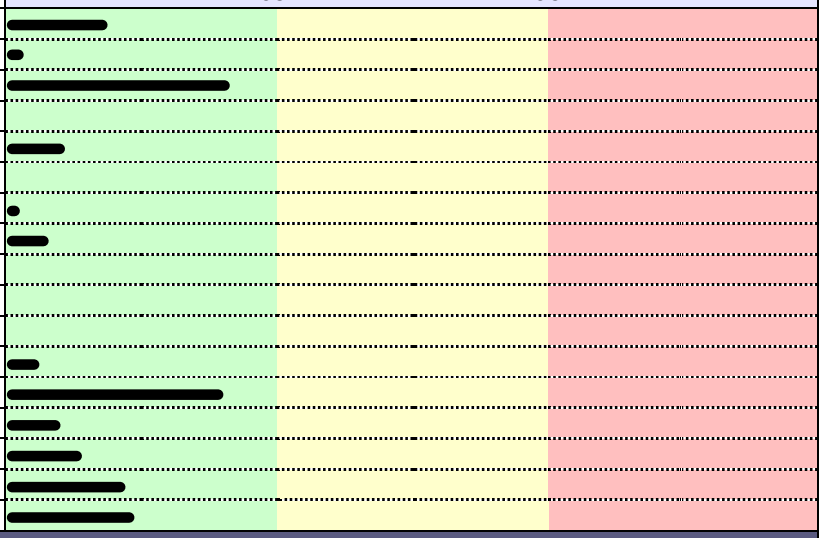
HAIR ELEMENTS

The Great Plains Laboratory, Inc.

LAB#:
PATIENT:
SEX: Female
AGE: 38
CLIENT#:

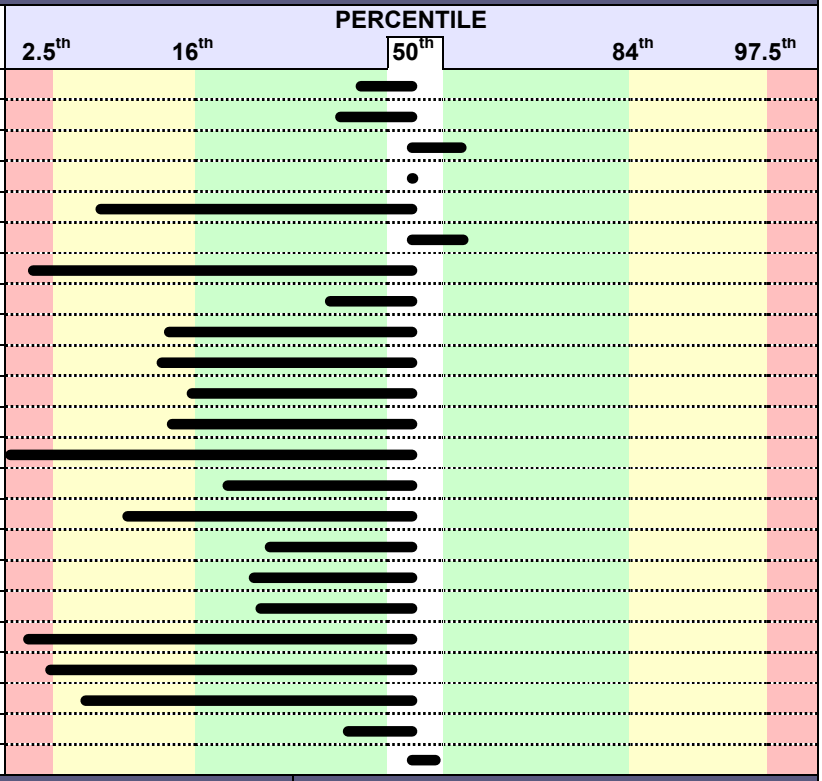
POTENTIALLY TOXIC ELEMENTS

TOXIC ELEMENTS	RESULT µg/g	REFERENCE RANGE
Aluminum	**2.5**	< 7.0
Antimony	**0.011**	< 0.050
Arsenic	**0.051**	< 0.060
Beryllium	**< 0.01**	< 0.020
Bismuth	**0.020**	< 0.10
Cadmium	**< 0.009**	< 0.10
Lead	**0.02**	< 1.0
Mercury	**0.16**	< 1.1
Platinum	**< 0.003**	< 0.005
Thallium	**< 0.001**	< 0.010
Thorium	**< 0.001**	< 0.005
Uranium	**0.006**	< 0.060
Nickel	**0.32**	< 0.40
Silver	**0.03**	< 0.15
Tin	**0.09**	< 0.30
Titanium	**0.44**	< 1.0
Total Toxic Representation		



ESSENTIAL AND OTHER ELEMENTS

ELEMENTS	RESULT µg/g	REFERENCE RANGE
Calcium	**600**	300- 1200
Magnesium	**48**	35- 120
Sodium	**52**	12- 90
Potassium	**15**	8- 38
Copper	**8.5**	12- 35
Zinc	**190**	140- 220
Manganese	**0.05**	0.15- 0.65
Chromium	**0.26**	0.20- 0.40
Vanadium	**0.016**	0.018- 0.065
Molybdenum	**0.025**	0.028- 0.056
Boron	**0.29**	0.30- 2.0
Iodine	**0.22**	0.25- 1.3
Lithium	**< 0.004**	0.007- 0.023
Phosphorus	**164**	160- 250
Selenium	**0.74**	0.95- 1.7
Strontium	**0.99**	0.50- 7.6
Sulfur	**45300**	44500- 52000
Barium	**0.44**	0.26- 3.0
Cobalt	**0.004**	0.013- 0.050
Iron	**3.5**	5.4- 14
Germanium	**0.029**	0.045- 0.065
Rubidium	**0.018**	0.007- 0.096
Zirconium	**0.11**	0.020- 0.42



SPECIMEN DATA

COMMENTS: 96998
Date Collected: 6/26/2006
Date Received: 7/1/2006
Date Completed: 7/6/2006

Methodology: ICP-MS

Sample Size: 0.196 g
Sample Type: Head
Hair Color:
Treatment:
Shampoo:

V06.99

RATIOS

ELEMENTS	RATIOS	EXPECTED RANGE
Ca/Mg	**12.5**	4- 30
Ca/P	**3.66**	1- 12
Na/K	**3.47**	0.5- 10
Zn/Cu	**22.4**	4- 20
Zn/Cd	**> 999**	> 800

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HAIR ELEMENTS REPORT
INTRODUCTION

Hair is an excretory tissue for essential, nonessential and potentially toxic elements. In general, the amount of an element that is irreversibly incorporated into growing hair is proportional to the level of the element in other body tissues. Therefore, hair elements analysis provides an indirect screening test for physiological excess, deficiency or maldistribution of elements in the body. Clinical research indicates that hair levels of specific elements, particularly potentially toxic elements such as cadmium, mercury, lead and arsenic, are highly correlated with pathological disorders. For such elements, levels in hair may be more indicative of body stores than the levels in blood and urine.

All screening tests have limitations that must be taken into consideration. The correlation between hair element levels and physiological disorders is determined by numerous factors. Individual variability and compensatory mechanisms are major factors that affect the relationship between the distribution of elements in hair and symptoms and pathological conditions. It is also very important to keep in mind that scalp hair is vulnerable to external contamination of elements by exposure to hair treatments and products. Likewise, some hair treatments (e.g. permanent solutions, dyes, and bleach) can strip hair of endogenously acquired elements and result in false low values. Careful consideration of the limitations must be made in the interpretation of results of hair analysis. The data provided should be considered in conjunction with symptomology, diet analysis, occupation and lifestyle, physical examination and the results of other analytical laboratory tests.

Caution: The contents of this report are not intended to be diagnostic and the physician using this information is cautioned against treatment based solely on the results of this screening test. For example, copper supplementation based upon a result of low hair copper is contraindicated in patients afflicted with Wilson's Disease.

Copper Low

Hair Copper (Cu) levels are usually indicative of body status with two exceptions: (1) addition of exogenous Cu (occasionally found in hair preparations or algaecides in swimming pools/hot tubs), and (2) low hair Cu in Wilson's or Menkes' diseases. In Wilson's disease, Cu transport is defective and Cu accumulates, sometimes to toxic levels, in intestinal mucosa, liver and kidneys. At the same time, it is low in hair and deficient in other peripheral tissues. In Menkes' disease, the activity of Cu dependent enzymes is very low. Cu supplementation is contraindicated in these diseases.

Cu is an essential element that is required for the activity of certain enzymes. Erythrocyte superoxide dismutase (SOD) is a Cu (and zinc) dependent enzyme; lysyl oxidase which catalyzes crosslinking of collagen is another Cu dependent enzyme. Adrenal catecholamine synthesis is Cu dependent, because the enzyme dopamine beta-hydroxylase, which catalyzes formation of norepinephrine from dopamine, requires Cu.

Symptoms of Cu deficiency include: elevated cholesterol, increased inflammatory responses, anemia, bone and collagen disorders, reproductive failure, and impaired immunity. Possible reasons for a Cu deficiency include: intestinal malabsorption, insufficient dietary intake, use of oral contraceptives, molybdenum excess, zinc excess, and chelation therapy. Cu status is adversely affected by excess of antagonistic metals such as mercury, lead, cadmium, and manganese.

Confirmatory tests for Cu deficiency are serum ceruloplasmin to rule out Wilson's disease (ceruloplasmin is deficient in Wilson's disease), a whole blood or packed red blood cell elements analysis, and a functional test for Cu (barring zinc deficiency) is measurement of erythrocytes SOD activity. Erythrocyte SOD activity is subnormal with Cu deficiency.

Iron Low

Hair Iron (Fe) levels do not correlate with Fe assimilation as determined by serum ferritin, Fe binding capacity, or transferrin saturation. A very low hair Fe result should be viewed only as possible indication for further tests because hair is only a screening test for this element. Fe supplementation is not indicated nor recommended solely on the basis of the measured hair Fe level. Unwarranted Fe supplementation, particularly in combination with ascorbic acid, can result in Fe overload. A large body of scientific literature indicates significant relationships between dietary Fe overload and heart disease, cancer, diabetes, osteoporosis, and arthritis. (Biochem. Mol. Med.; 54(1):1-11, 1995)

Manganese Low

Hair Manganese (Mn) levels correlate well with Mn levels in other body tissues. Hair Mn levels are commonly low, in part due to low dietary Mn intake and the interaction of Mn with phosphates in the gut. Intestinal malabsorption also limits Mn uptake.

Mn is an essential element that is involved in energy metabolism, and bone and cartilage formation. Mn is an activator of many important enzymes including: mitochondrial superoxide dismutase, arginase, and pyruvate carboxylase.

Symptoms associated with Mn deficiency include: fatigue, lack of physical endurance, slow growth of fingernails and hair, impaired metabolism of bone and cartilage, dermatitis, weight loss, and reduced fertility. Increased allergic sensitivities and inflammation are often associated with low Mn. Seizures are occasionally reported to be associated with severe Mn deficiency.

An appropriate laboratory test to confirm Mn deficiency is whole blood elements analysis.

Cobalt Low

One can not determine vitamin B-12 status by use of hair analysis, and the clinical significance of low hair Cobalt (Co) levels is not known. Hair is analyzed for Co primarily for detection of excessive intake of the potentially toxic element.

There is little evidence that Co has an essential function in humans other than as an obligatory constituent of the vitamin B-12 molecule. Humans absorb Co as inorganic Co and as vitamin B-12; the body pools of each fluctuate independently. Humans cannot convert inorganic Co to vitamin B-12.

The dietary content of Co is highly variable, depending upon types of foods eaten, geographical location and type of soil. Vegetarians often have lower Co levels than meat eaters.

Appropriate tests for determination of vitamin B-12 status are the measurement of urine levels of methylmalonic acid (elevated with vitamin B-12 coenzyme deficiency/dysfunction), a quantitative blood

assay for vitamin B-12, a urine amino acids analysis (several metabolic steps require vitamin B-12), and diet analysis.

Vanadium Low

Vanadium (V) is typically found at low levels in hair and the clinical significance of the measured result of lower than average hair V is not known. V is measured in hair for research purposes because it has been postulated to be an essential microtrace element. Indirect data to support this postulate have been derived from experimental models. Suggested functions for V include: regulation of sodium-potassium-ATPase, intracellular glutathione metabolism, thyroid metabolism, and insulin mimetic effects at pharmacological doses.

Average dietary V intake varies considerably between 20 mcg to 2 mg. Food sources of V include: liver, fish, radishes, grains, nuts, and vegetable oils.

Molybdenum Low

Low Molybdenum (Mo) in hair is a possible indication of Mo deficiency. Hair is very rarely contaminated with exogenous Mo.

Mo is an essential trace element that is an activator of specific enzymes such as: xanthine oxidase (catalyzes formation of uric acid), sulfite oxidase (catalyzes oxidation of sulfite to sulfate), and aldehyde dehydrogenase (catalyzes oxidation of aldehydes). Possible effects or symptoms consistent with Mo deficiency are: subnormal uric acid in blood and urine, sensitivity or reactivity to sulfites, protein intolerance (specifically to sulfur-bearing amino acids), and sensitivity or reactivity to aldehydes.

True Mo deficiency is uncommon but may result from: a poor-quality diet, gastrointestinal dysfunctions, or tungsten exposure. Tungsten (from ”TIG” welding) can be a powerful antagonist of Mo retention in the body. Copper overload can also reduce Mo retention.

Because normal blood and blood cell Mo levels are very low (a few parts per billion), blood measurement is not an appropriate tissue for confirmation of subnormal molybdenum.

Confirmatory tests for Mo deficiency include measurement of urine sulfite concentration (increased in Mo deficiency), measurement of blood/urine uric acid level (decreased in Mo deficiency), and measurement of urinary Mo content.

Boron Low

Boron (B) is normally found in hair, but the correlations among dietary B intake, and tissue and hair levels of B have yet to be established. Recent studies clearly indicate that B has an important role in normal bone metabolism/density and may be needed for normal membrane function. In post-menopausal women consuming a very low B diet, B supplementation significantly lowered urinary excretion of calcium and magnesium and increased serum levels of estrogen (Environ. Health Persepct.; 102 Supl.7: 59-63, 1994). Further research is in process to determine the clinical significance of hair B levels.

Lithium Low

Lithium (Li) is normally found in hair at very low levels. Hair Li correlates with high dosage of Li carbonate in patients treated for Affective Disorders. However, the clinical significance of low hair Li levels is not certain at this time. Thus, hair Li is measured primarily for research purposes. Anecdotally, clinical feedback to DDI consultants suggests that low level Li supplementation may have some beneficial effects in patients with behavioral/emotional disorders. Li occurs almost universally in water and in the diet; excess Li is rapidly excreted in urine.

Li at low levels may have essential functions in humans. Intracellularly, Li inhibits the conversion of phosphorylated inositol to free inositol. In the nervous system this moderates neuronal excitability. Li also influences monamine neurotransmitter concentrations at the synapse (this function is increased when Li is used therapeutically for mania or bipolar illness).

A confirmatory test for low Li is measurement of Li in blood serum/plasma.

Selenium Low

Selenium (Se) is normally found in hair at very low levels, and several studies provide evidence that low hair Se is reflective of dietary intake and associated with cardiovascular disorders. Utilization of hair Se levels to assess nutritional status, however, is complicated by the fact that use of Se- or sulfur-containing shampoo markedly increases hair Se (externally) and can give a false high value.

Se is an extremely important essential element due to its antioxidative function as an obligatory component of the enzyme glutathione peroxidase. Se is also protective in its capacity to bind and ”inactivate” mercury, and Se is an essential cofactor in the deiodination of T-4 to active T-3 (thyroid hormone). Some conditions of functional hypothyroidism therefore may be due to Se deficiency (Nature; 349:438-440, 1991); this is of particular concern with mercury exposure. Studies have also indicated significant inverse correlations between Se and heart disease, cancer, and asthma.

Selenium deficiency is common and can result from low dietary intake of Se or vitamin E, and exposure to toxic metals, pesticides/herbicides and chemical solvents.

Symptoms of Se deficiency are similar to that of vitamin E deficiency and include muscle aches, increased inflammatory response, loss of body weight, alopecia, listlessness, skeletal and muscular degeneration, growth stunting, and depressed immune function.

Confirmatory tests for Se deficiency are Se content of packed red blood cells, and activity of glutathione peroxidase in red blood cells.

Total Toxic Element Indication

The potentially toxic elements vary considerably with respect to their relative toxicities.
The accumulation of more than one of the most toxic elements may have synergistic adverse effects, even if the level of each individual element is not strikingly high. Therefore, we present a total toxic element ”score” which is estimated using a weighted average based upon relative

toxicity. For example, the combined presence of lead and mercury will give a higher total score than that of the combination of silver and beryllium.